

all vectorial, that is, geometrical, and marked by great clearness of exposition. Such a treatment of statics forms a most needful corrective of the methods of a purely "analytical statics," which has a strong tendency to keep the subject aloof from reality, and to obscure its physical nature. "One does not find figures in this book," boasted Lagrange in his "Mécanique Analytique," but the absence of geometrical methods and conceptions is not to the advantage of the subject.

In the penultimate chapter Prof. Henrici gives a short, very useful, and well explained account of the reciprocal figures of graphic statics, and the last chapter is a very short one on the deduction of the elementary trigonometrical formulæ from vector methods. With all deference to the author, however, it is to be feared that pupils will not, within time at the earth's disposal, be so much accustomed to think in vectors as to deduce their notions of a sine and a cosine otherwise than by the old method.

Next to the systematic teaching of the solution of all kinds of equations by graphic constructions, the wider employment of geometrical methods in dynamics is our greatest desideratum, and for this reason we have to thank Prof. Henrici for this elegant little treatise.

GEORGE M. MINCHIN.

THREE PROTOZOAN ARTICLES.

A Treatise on Zoology. Edited by E. Ray Lankester, LL.D., F.R.S., &c. Part i. Introduction and Protozoa. Second Fascicle. Pp. vi+451. (London: A. and C. Black, 1903.) Price 15s. net.

THE erratic order in which the various volumes of Prof. Lankester's treatise are appearing is, from the nature of their subject, a matter of very little consequence, and we are glad to welcome now this instalment of the protozoan chapter. It is the second fascicle of part i., of which the first fascicle, containing the introduction and the groups not here included, has still to appear. The inconvenience of the intended arrangement of parts is clearly demonstrated, and it is very fortunate that it has not resulted in the detention at the press of the valuable essays which make up this volume. A large part of the editor's difficulties have resulted, it is clear, from his adherence to the plan of producing bound volumes of nearly uniform size—in following, that is to say, the mode of publication of the recent "Cambridge Natural History" and of other similar works of collaboration. We believe it would prove to be in the interest of authors and readers alike if no attempt were made by the editors of series of this kind to produce periodically completed volumes, and if the separate articles were issued uniformly, but unbound, in the style of German monographs. The total expense to the purchaser of the whole series could remain the same by an obvious arrangement, while the gain to many specialists would be immense. We have a case in point in the present volume. Prof. Minchin's valuable monograph on the Sporozoa occupies about one-half of the whole volume, and might, we gather, have been already for some time in our hands if it had appeared separately in paper covers. Its subject is precisely one in which publication might well have been both early and individual

NO. 1774, VOL. 68]

in the interests of the medical profession, for which it has, perhaps, its chief importance at the present time. The deliberate manufacture of volumes, as such, while we can see nothing at all to recommend it, is exposed at the same time to the serious objection of stimulating over-production. The publication of a complete "Cambridge Natural History," and now of what is virtually an Oxford treatise, suggests inevitably that among the whole body of English zoologists a good deal of research has been recently sacrificed to textbook writing, of which a large part, however conscientious, has been redundant.

We can say this now with the greater assurance, because it cannot be taken as applying to the excellent articles on the Foraminifera, the Sporozoa, the Ciliata, and the Acinetaria in the present volume. The section dealing with the Sporozoa, by Prof. Minchin, takes its place as an admirable systematic account of the group, prefaced by a general sketch of their characters and of the typical life-history. The recent developments of our knowledge of sporozoan parasites in connection with malarial disease give a special importance, as we have said, to this monograph. Prof. Minchin provides in his description of the Hæmosporidia exactly what is now becoming essential knowledge for the student of disease, and it is highly desirable, we think, that medical men should approach the study of this group from a more general point of view than that permitted in the restricted accounts of the malaria parasite written specially for their use. In the interests of further developments of curative and preventive treatment in new directions, it is of the first importance that the morphology and life-cycles of the members of this group should be completely determined, although, as the author claims, "the life-cycle of the malarial parasite is now thoroughly known in all its features." The recent work of Schaudinn, who has explained the occurrence of relapse in malaria without fresh infection as due to a kind of parthenogenetic reproduction by resistant and long-lived macrogametocytes, is an example of the value in these inquiries of a zoological outlook, and it is to be remembered that the "black spores" of Ross have not yet been assigned with certainty to their place in a life-cycle. With regard to the voluminously alleged connection between the Sporozoa and cancer, Prof. Minchin is content to express the hostility of most zoologists, but he gives all the necessary material for following the discussion elsewhere. In summing up the affinities of the whole group he decides against the theory of Euglenoid ancestry which Bütschli advanced, and argues in favour of a descent from the Rhizopoda, quoting the interesting example of parasitism which Schewiakoff has found in simple amoeboid forms. He concludes his article with a valuable compilation of sporozoan hosts, including Labbé's list with modern additions, and an abundant bibliography is appended, brought up to the beginning of the present year. It would be difficult to suggest any improvement in the author's selection of illustrations or in their execution.

Prof. Hickson, who has undertaken the Infusoria, does not include the Flagellata, but deals only with the Ciliata and Acinetaria, grouped as the Corticata Heterokaryota. Here again we can have nothing but praise for his admirably illustrated account of these

classes, and can only regret that it has been necessarily rather compressed. The limits of space have forced the author to deal briefly with the physiological inquiries for which the Ciliata have provided such a wonderfully fertile field. The work of Verworn and others upon the nuclear functions by means of "protozoan vivisection," and the studies of Miss Greenwood in intracellular digestion, are very shortly dealt with, while the classical accounts by Maupas of the processes of reproduction among the Ciliata deserve more expansive treatment than they receive in Prof. Hickson's excellent summary. Enough is given, however, of these biological studies to illustrate the author's discussion of the significance of the heterokaryote body, the individuality of the Infusoria after conjugation, and the incidence of somatic death among them, with which he prefaces his descriptive classification of the whole group.

The Foraminifera are dealt with in an article of the highest distinction by Mr. Lister, whose powers of lucid description, together with many original drawings and photographs of first-class merit, allow the reader to follow, perhaps for the first time with ease, the intricacies of skeletal structure and life-history found in this group. A unique value is given to this section by the inclusion within it of Mr. Lister's own researches into the remarkable phenomena of dimorphism in the Foraminifera, which he illustrates by a complete account of the alternation of the microspheric and megalospheric generations in the life-cycle of *Polystomella*. This dimorphism, with other characters, is followed through the various groups of Foraminifera so far as our present knowledge allows, and the facts are summed in a concluding survey, to which is appended a systematic classification and bibliography. Mr. Lister lays stress on the importance of life-history as evidence in the determination of phylogeny in this group, and this is becoming more and more evident in the case of other groups also of Protozoa. As an example of the questions of fundamental importance which are likely to arise in the further study of these life-histories may be noted the occurrence of the multi-form condition especially in the microspheric generation, which Mr. Lister has ingeniously compared with the repetition of ancestral form seen in the sexually produced larva of the Cladoceran *Leptodora*, but not in its parthenogenetically developed young. This section marks a brilliant advance in description of the Foraminifera, and Mr. Lister is to be heartily congratulated upon it.

The earlier pages of the volume are given to an article by Prof. Farmer on the structure of animal and vegetable cells, of which, short as it is, nearly one-half is devoted to the discussion of reducing divisions and to some other physiological points. The problem of the structure of protoplasm and of the resting nucleus is dealt with, on the whole, perfunctorily, and is nowhere illuminated by reference to the results of Fischer and others in connection with the action of fixatives—results notably confirmed and extended in this country by Hardy—which already promise to remove these questions from the dust of a microscopists' quarrel and place it on the stage of exact physical inquiry.

PRACTICAL PHOTOGRAPHY.

Carbon Photography made Easy. By Thos. Illingworth. Pp. 150. (London: Iliffe and Sons, Ltd., 1903.) Price 1s. net.

Portraiture for Amateurs without a Studio. By Rev. F. C. Lambert, M.A. Part i. (Technical) and Part ii. (Pictorial). Pp. iv+176. (London: Hazell, Watson and Viney, Ltd., 1903.) Price, each part, 1s. net.

The Elementary Chemistry of Photographic Chemicals. By C. Sordes Ellis, F.I.C., F.C.S. Pp. 120. (London: Hazell, Watson and Viney, Ltd., 1903.) Price 1s. net.

Photography by Rule. By J. Sterry. Pp. 124. (London: Iliffe and Sons, Ltd., 1903.) Price 1s. net.

PHOTOGRAPHY as now practised may be regarded from so many points of view, and pursued for so many different purposes, that it is desirable to have treatises on special branches of it, such as those now under notice. A considerable advantage of this method of setting forth the facts and methods of photography is that each section may be dealt with by one who has paid special attention to it, and is able to speak upon it with authority.

Mr. Illingworth, for example, is a man whose business very largely consists in the making of carbon prints. His practical directions are, therefore, beyond criticism, and we put up with, without a murmur, his reference to "chloride, bromide, platinum, or other commoner printing processes" because of the frank and full way in which he describes the process in which he is a specialist. His book would have been better without the chapter devoted to the "Chemistry of the Carbon Process," for here he has gone outside his experience and his knowledge, and what he has set down tends to error and confusion. The discriminating student will discover this for himself, but beginners cannot always separate the wheat from the chaff, and it is for beginners that the book appears to be chiefly intended.

In a volume on the chemistry of photographic chemicals one looks for a special knowledge of the chemicals used in photography, but in the book before us there is not much evidence of this. The author appears to go out of his way to say that a "chemical change theory" of the developable image "is the one generally accepted at the present day." We very much doubt it. But in the matter that deals with the subject as set forth by the title, there are many statements that need modification, if not correction. Silver nitrate is doubtless the most important of all "photographic chemicals," but only little more than a dozen lines are devoted to its consideration. We are told that when prepared by dissolving silver in nitric acid hydrogen is evolved, and that when obtained in the solid form, preferably by fusion, it is not likely to be alkaline. Now fused silver nitrate often is alkaline, and as to the equation showing hydrogen liberated from nitric acid by the metal, the less said the better. We are told that the oxidation of sodium sulphite to sulphate by exposure to the air "is easily detected by the crystals becoming powdery and opaque,"